DEMOGRAPHIC AND HEALTH SURVEYS FROM GUATEMALA, JORDAN, AND MALAWI REPORTED LOWER MEAN HEMOGLOBIN VALUES IN CHILDREN THAN MICRONUTRIENT STATUS SURVEYS

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BACKGROUND

Demographic and Health Surveys (DHS) and micronutrient status surveys (MNS) report hemoglobin concentration and anemia prevalence. However, there is variation in measured hemoglobin concentration due to blood sampling type (capillary or venous), different HemoCue models, environmental factors like heat and humidity, and so on. We identified three countries—Guatemala, Malawi, and Jordan—in which DHS and MNS conducted within 1–2 years of each other reported highly discordant results for prevalence of anemia in children aged 6–59 months. Our study explores variation in hemoglobin concentration from different surveys and examines how the distribution of hemoglobin concentration can explain part of the variability in its value, and consequently, differences in anemia prevalence.

RESEARCH METHODS

We used individual data from the following DHS and micronutrient status surveys:

- Malawi (2015–16 DHS and 2016 MNS)
- Guatemala (2014–15 DHS and 2015 MNS)
- Jordan (2009 DHS and 2010 MNS).

We used hemoglobin measurements from children age 6–59 months for our analysis.

The key outcome variables were—

- *Hemoglobin:* in g/dL, adjusted for altitude in the datasets. We excluded any hemoglobin measurements that were less than 4.0 g/dL or greater than 18.0 g/dL (20,21).
- *Anemia:* Altitude-adjusted hemoglobin concentration <11 g/dL, as per the World Health Organization guidelines.

We used three categories for the child's age: 6–11 months (note: not in Jordan's MNS: age range 12–59 months), 12–23 months, and 24–59 months.

In each country, we conducted univariate analysis with comparison of DHS and MNS results to determine—

- quantitative distribution of hemoglobin concentration (mean, median, range, and standard deviation)
- graphic representation of hemoglobin concentration (cumulative frequency distribution graphs)
  — sub-group analysis: 6–11 months, 12–23 months, and 24–59 months

Table 1. Results—Population Characteristics

	Malawi		Guatemala		Jordan	
	DHS	MNS	DHS	MNS	DHS	MNS
Sample size	4,676	1,174	10,385	686	4,221	956
Anemia (%)	63	28	32	12	34	19
Hb (mean ± S.D.)	10.4 ±1.5	11.4 ± 1.4	11.4 ±1.3	12.0 ± 1.0	11.4±1.4	11.7±1.1
Site	Heel/finger	Arm	Heel/finger	Finger	Heel/finger	Arm
Type	Single-drop capillary	Venous	Single-drop capillary	Pooled capillary	Single-drop capillary	Venous
Instrument	HemoCue 201+	HemoCue 301	HemoCue 201+	HemoCue 301	HemoCue 201+	Auto-analyzer

Figure 1. Results—Cumulative Frequency Distribution of Hemoglobin Concentration

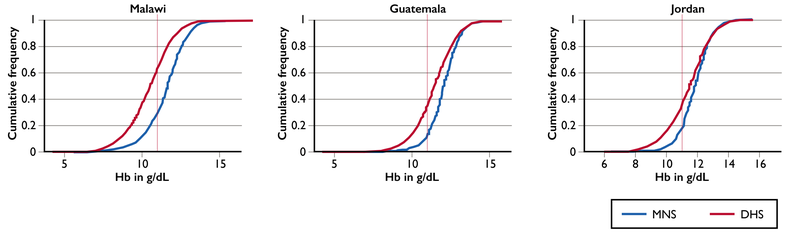
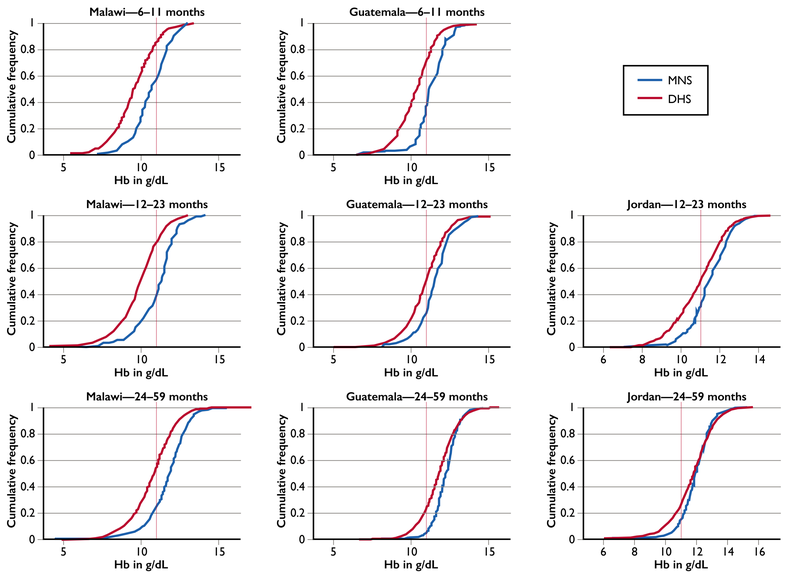


Figure 2. Results—Age Groups and Cumulative Frequency Distribution of Hemoglobin Concentration



Hemoglobin measurement in population surveys may overestimate anemia.

DISCUSSION

DHS surveys reported lower mean hemoglobin (with wider standard deviations), which may partly explain their higher reported anemia prevalence as compared to MNS. The differences were amplified in the 6–11-month and 12–23-month age groups. Use of capillary versus venous/pooled capillary may be a contributing factor for these differences.

DHS surveys are widely used to set policy on anemia. Thus, differences in classification of severity of anemia as a public health problem has major implications for resource commitment. Discordant prevalence of anemia, reported from the same country from two simultaneous surveys, will lead to confusion and indecision.

CONCLUSION

Future research needs to prospectively examine the impact on hemoglobin measurement of the blood collection type and instrument used to read results.

ACKNOWLEDGEMENT

We acknowledge the technical review that Erin Milner from USAID's Bureau for Global Health provided in the development of the study, and this poster.

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This poster was produced for the U.S. Agency for International Development. It was prepared under the terms of contract 7200AA18C00070 awarded to JSI Research & Training Institute, Inc. The contents are the responsibility of JSI and do not necessarily reflect the views of USAID or the U.S. Government.

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